2023-24 Adelaide Summer Research Scholarships.

Researchers listed in this document are interested in supervising students for Summer Research Scholarships in the Faculty of Sciences, Engineering and Technology.

Eligible students are encouraged to contact Researchers to discuss their research projects and potential supervision for a Summer Research Scholarship.

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AUSTRALIAN INSTITUTE FOR MACHINE LEARNING:

Researcher:	Research Area:	Available Project(s):
Dr Lingqiao Liu	Machine Learning, Computer Vision, Natural Language processing	**Automatic Poster Generation from Scientific Research Papers: Leveraging Advanced Machine Learning Techniques:** This project endeavours to harness the power of cutting-edge Machine Learning Technologies, specifically the utilization of Large Language Models and Computer Vision methods, to construct an innovative system capable of automatically generating visually appealing posters from scientific research papers. The objective is to provide a comprehensive exploration of the methodologies employed for collecting and processing training data, as well as the development of an advanced machine learning solution tailored to address the inherent challenges of this task.
Dr Yongliang Qiao	Computer science; Smart Agriculture	**AI-based Object Detection:** Object detection is a fundamental task in computer vision that involves identifying the presence and location of objects in images or videos. The goal of this project is to explore techniques for improving the performance of object detection models, such as data augmentation, transfer learning, and model ensembling. By improving the accuracy of object detection models, we hope to contribute to the development of more reliable and efficient computer vision systems with a wide range of applications.
Dr Vu Minh Hieu Phan	Deep learning; Medical image analysis	**Apply a visual foundational model for tumour segmentation:** Visual foundational models such as Segment-Anything Model (SAM) achieve accurate segmentation performance on unseen scenarios. However, the performance of SAM on medical images is non-optimal. Leveraging foundational models and adapting for segmenting tumours on medical scans is a challenging, yet attractive area of research.
Dr. Jinan Zou	Machine Learning; Fintec	**ChatGPT on stock market prediction:** This project aims to predict the future behaviour of the stock market using machine learning techniques. The stock market's performance is influenced by various factors, including market trends and news from social media platforms. This project seeks to leverage machine learning, especially ChatGPT to explore the key impact factors and develop a classification algorithm for applications.
Zhibin Liao	Medical Machine Learning	**Deep Inversion for Medical Image Reconstruction Using Generative Adversarial Networks:** Generative Adversarial Networks (GANs) can generate realistic and high-fidelity synthetic images. GAN inversion aims to generate images with semantical meanings by editing images in a controllable way, using existing GAN models. In the medical domain where data is often limited, GAN inversion can alleviate the need for enormous training data.

Dr Antonios Perperidis and Dr Minh-Son To	Healthcare Artificial Intelligence	**Intelligence-Based Analysis of Sarcoma MRI for predicting Histological Grade:** Accurate diagnosis and characterisation of bone and soft tissue tumours, particularly malignant sarcomas, are crucial for effective treatment planning and patient care. Magnetic resonance imaging (MRI) can aid in detection and diagnosis of sarcomas. This project will develop artificial intelligence algorithms for automated detection, segmentation, classification and grading of sarcomas on diffusion-weighted MRI. There are alternative project options, please contact researcher for discussion.

SCHOOL OF AGRICULTURE, FOOD AND WINE:

Researcher:	Research Area:	Available Project(s):
Jenny Mortimer	Plant synthetic biology/biochemistry	**Plants for Space:** View our projects online.
Shashi Goonetilleke, Philip van Eyk & Cas Collins	Molecular biology and genetics	**Almond hull as an ingredient in beer:** Beer rich in phenolic content and antioxidants exhibits higher quality, more stable flavour, and aroma. Fruit beers have reported to contain considerably higher polyphenol and antioxidant contents than that in conventional beers. This project aims to examine the suitability of almond hull as a raw material in beer production.
Dr Bryan Coad	Chemistry / Materials Science	**Improving biodegradable food packaging plastic films:** Renewable bioplastics are an alternative to unsustainable petroleum plastics. This project aims to improve the chemical and physical properties of a biodegradable bioplastic being developed in my lab with the aim of making it a better alternative to petroleum-based plastics.
Assoc. Prof Stuart Roy	Agriculture - yield enhancement and abiotic stress tolerance of crops	**Pass the salt please** Accumulation of sodium (Na+) ions in crop leaves is typically linked to reduced yields. We have developed wheat lines which can tolerate 10X as much Na+. We want to determine whether these plants have enhanced yield in dryland cropping. View our online resources.
Jo Zhou	Food & Nutrition Science	**Alternative Protein, Food Waste** Please contact researcher for discussion.
Helen Morris	Food science; Food waste	1. **Used coffee ground waste from quick service restaurants (QSRs):** 2. **Used (spent) coffee grounds contribute to food waste from foodservice outlets:** The Australian government has set a target of halving food waste by 2030. This project will explore the contribution of used coffee grounds to food waste from quick service restaurants and alternate destinations for this type of waste. The project is suitable for up to 2 students.

Hayriye Bozkurt	Food Science and Technology	Please contact researcher for discussion.
Megan Shelden	Plant science; Grapevine physiology	Please contact researcher for discussion.
Dr Julie Hayes	Plant genetics; Grain quality.	Please contact researcher for discussion.

SCHOOL OF ANIMAL AND VETERINARY SCIENCES:

Researcher:	Research Area:	Available Project(s):
A/Prof Erik Noschka	Oxidative stress	**Effects of alternative antimicrobial compounds on semen quality:** This project will assess the effects of novel antimicrobial compounds on the quality of boar semen. These compounds will be used in place of conventional antibiotics, with the purpose of reducing industry reliance on antibiotics.
Natasha Speight	Koala health and disease	**Contributing factors for the kidney disease oxalate nephrosis in South Australian koalas:** This project will involve conducting some measurements on stored samples to assist the project.
Kiro Petrovski	Animal Production and Veterinary Medicine	**Testing of the antimicrobial activity of a variety of metals in vitro:** The project will use variable concentrations of diluted metals using the Minimum Inhibitory Concentrations testing approach. It is purely laboratory-based research.
Dr Farrah Preston	Meat science	**The Goldilocks lamb:** Using optimisation to align the right carcase with the right fabrication plan. The value of optimisation in the allocation of beef carcases to fabrication plans: tool development and test cases A novel application of plasma-activated water to improve quality characteristics of dark cutting beef
Caitlin Evans and Mandi Carr	Livestock health; biosecurity; disease surveillance	**Determining the prevalence of disease in South Australia's feral livestock species:** This project will collect sera from South Australian feral goats and/or deer and test for antibodies to highly important endemic diseases of domesticated livestock such as Pestivirus, Johne's disease and Q fever.
Dr David Peacock	School of Animal and Veterinary Sciences	**Examining inter-annual spatial and temporal spread of the rabbit biocontrol, rabbit haemorrhagic disease virus (RHDV), at the Turretfield rabbit research site:** I have multiple projects (just ask), but this primary Summer Research Project is examining the spatial and temporal death of rabbits

		recorded during RHDV outbreaks over ~23 yrs at the Turretfield rabbit research project. We monitored every known RHDV outbreak at Turretfield, and when a rabbit (tagged or untagged) was found dead its location was recorded. This may be in or on a rabbit warren, in the open, in a hollow log, etc. Our database containing this data also contains the coordinates of the warrens (hence of the associated dead rabbits), but also an approximate location of the other rabbit carcasses (e.g. ""20m north of warren 7"") allowing them to be spatially mapped. Is there a pattern? Are their hotspots for RHDV mortality?
Megan Tscharke, Dr Caitlin Evans and Assoc. Prof William van Wettere	Livestock reproduction and heat stress	**Understanding the impact of heat stress on rams:** Determining the impact heat stress (Days >32C) has on ram fertility and behaviour, and trialing what supplementation options could reduce these impacts. Contact researchers for discussion.

SCHOOL OF ARCHITECTURE AND CIVIL ENGINEERING:

Researcher:	Research Area:	Available Project(s):
Jian Zuo	Smart and sustainable construction	**Circular economy for built environment.** Contact researcher for discussion
Giang D. Nguyen	Civil Engineering / Mechanics & failure of Materials, including 3D printed materials	**3D printing of concrete:** The research will focus on fundamentals of failure of 3D printed concrete materials. 3D printed materials in general and concrete in particular is weak along the interfaces between layers, due to inherent characteristics of 3D printing process. Contact researcher for discussion
Kevin Farries	Lunar Civil Engineering	**Lunar Geotech Surveying Rover:** In this project you will develop the capability of existing rovers to build a prototype lunar geotech surveying robot. This project will combine programming, mechatronics and geotechnical engineering. You will improve the mobility of the robot, integrate instrumentation and test the prototype in simulated lunar environments.
Dr Larissa Arakawa Martins	Architectural sciences, housing and thermal comfort	**A Breath of Fresh Air: New evidence on ventilation as a risk modifier for disease in older persons of low socio-economic status:** The project investigates ventilation as an important risk modifier for disease arising from exposure to bioaerosols (e.g. respiratory viruses), VOCs and thermal parameters in homes. Older Australians of low socio-economic status represent a highly vulnerable group, but high-quality evidence on ventilation is lacking. Air exchange data along with predictive modelling and building performance simulation will underpin a Position Paper with tailored recommendations.

SCHOOL OF BIOLOGICAL SCIENCES:

Researcher:	Research Area:	Available Project(s):
Professor Ivan Nagelkerken	Marine Ecology	**Climate change, fish ecology, marine ecology, animal behaviour, leafy seadragon, mangroves:** Please contact researcher for discussion.
Dr Danny Wilson	Biology of malaria and related parasites	**Gene editing in malaria:** Malaria parasites have many unique genes. This project will build new gene-editing plasmids and characterise the impact of gene-editing on the behaviour of individual proteins and parasite growth. Additional projects looking at drug and vaccine development are available- Best to contact researcher for discussion.
Associate Professor Keith Shearwin	Biochemistry and synthetic biology	**Bacteriophage discovery and characterisation:** Bacteriophage (phage) are viruses which infect and kill bacteria. There has been a resurgence of interest in using bacteriophage as antibacterial agents for the treatment of antibiotic resistant bacterial infections. In this project you will hunt for new bacteriophage able to infect specific bacterial targets. You will characterise the phage by a number of techniques including electron microscopy and nanopore sequencing. The chances are high that you will discover a new variety of phage.
Professor Steven Cooper	Ecology and evolution; molecular evolution	**Evolution of sensory systems in the dark biosphere:** This project utilises a unique Australian model system based on multiple, independently-evolved subterranean water beetles to investigate the evolution of genes involved in circadian rhythms. Circadian rhythms are usually entrained to a 24-hour clock by light in insects, but it is unknown what happens to Circadian rhythms, and their associated genes, when insects live in permanent darkness and become blind. Please contact researcher for discussion.
Professor Bronwyn Gillanders	Marine ecology	**Fish/fisheries ecology, and plastics in the environment:** Please contact researcher for discussion.
Dr. Sami Rifai	Terrestrial ecosystems, Earth Observation, Global change ecology	Multiple projects - please contact researcher for discussion.
Dr. Jack da Silva	Genetics; Evolutionary Genetics	**Dog lifespans and the evolution of ageing:** Large dog breeds live longer than small breeds. This tells us something interesting about how ageing evolves. Computational methods will be used to estimate rates of ageing from life tables for individual breeds.
Prof. Kishan Dholakia	School of Biological Sciences	**Schlieren imaging of acoustic traps:** Schlieren imaging uses spatial filtering to allow us to observe liquid or gas fluid flow to identify regions of high and low density. You'll use this technique to image our acoustic trap that uses sound waves to trap

		macroscopic particles. You will build a setup and analyse the images obtained. **Raman spectroscopy for whisky identification and contamination detection:** Raman spectroscopy measures molecular vibrational bands by inelastic light scattering. You'll use this to identify brands and the molecular constituents of whisky and/or presences of contaminants. We use this to identify if the whisky has been tampered with. Help us refine this system and develop techniques for this application. **Laser beam shaping: exploring vortex beams and wavefront detection:** Shaping light can lead to laser fields that overcome diffraction and can create phase singularities (vortices). You'll explore these unusual transverse spatial mode profiles and measure the optical phase, amplitude and propagation properties. Such vortex beams/twisted beams will be used to test new ways of manipulating and imaging biological samples.

SCHOOL OF CHEMICAL ENGINEERING:

Researcher:	Research Area:	Available Project(s):
Dr. Junnan Hao and Prof. Shi-zhang Qiao	Material Science; Renewable Energy	**Aqueous Zn-ion batteries:** ZIBs are much safer and cheaper than current Li-ion batteries due to the water-based electrolyte and abundant Zn reserves. However, the state-of-the-art ZIB technique faces huge challenges for practical applications due to the low cathode capacity and poor Zn anode reversibility. This project aims to design novel cathodes with a new-type mechanism and highly reversible Zn anodes. Accordingly, on-demand large-size ZIBs and flexible devices under industrial parameters will also be developed. The expected outcomes will generate advanced aqueous batteries in real applications, such as solar panel systems and wearable devices.
Abel Santos	Materials Science	**Engineering of solid-state random lasing in nanoporous anodic alumina photonic crystals:** In this project we will engineer the self-organized structure of nanoporous anodic alumina (NAA) through electrochemical oxidation of aluminum to generate a palette of model nanoporous platforms with tailored, hexagonally distributed, straight cylindrical nanopores. The inner surface of these platforms will be functionalized with a model organic fluorophore via micellar solubilization of a surfactant. The resultant organic–inorganic composite structures will provide model platforms to develop optically pumped solid-state random lasers with well-resolved, intense lasing bands. The effect of NAA's geometric features on the random lasing characteristics of these model platforms will be elucidated by precisely engineering its nanopore diameter, nanopore length, interpore distance, and ordering. Random lasers based on NAA will provide new opportunities to engineer cost-

		competitive, highly controllable, and integrable light sources for a broad range of photonic technologies such as sensing, hyperspectral imaging, high-resolution spectroscopic analysis, and photonic circuits. **Bioinspired engineering of iontronic membranes for osmotic energy generation:** The overarching aim of the project will be to design and engineer the first iontronic technology that mimics the ability of ionic nanochannels in neurons to modulate ionic flow for osmotic electric energy generation. At a more fundamental level, we will seek to understand interactions between photons, electrons, and ions in these bioinspired synthetic nanochannels to maximise efficiency of green energy generation. **Engineering of light–matter interactions in hybrid plasmonic–photonic crystal structures:** The overarching aim of the project will be to design and engineer an innovative plasmonic–photonic crystal platform technology to strongly localise and confine electromagnetic waves through constructive recirculation of light. At a more fundamental level, we will seek to understand interactions between photons and matter in these systems to maximise sensitivity and radiative rate for sensing and lasing applications.
A/Prof Yan Jiao	Materials Engineering; Molecular Modelling	**A Taste of Research - Energy Materials Design by Molecular Modelling:** As renewable energy capacity grows, efficient storage and conversion become crucial. Converting clean electricity into chemical energy, like fuels and chemicals, is a promising solution. Molecular modelling plays a vital role in developing efficient energy materials for this purpose - with the possibility of incorporating artificial intelligence. Multiple projects are available. Please contact the researcher for discussion.
Xiaoyong Xu	Chemical Engineering; Hydrogen production; Hydrogen usage	**Development of advanced cathode materials for proton-based solid oxide cells:** Please contact the researcher for discussion.
Manuel Varon Hoyos	Chemical Engineering	**Lunar highland regolith simulant as a potential source of P:** By means of the use of acid leaching applied to a lunar highland regolith simulant it is sought to establish whether this material can be a viable source of phosphorus for the production of fertilizers required for hydroponic space farming systems. Please contact the researcher for discussion.
Lachlan Maddaford	Chemical Engineering	**Validating Material Balance Model for the Remediation of PFAS via Continuous-mode Foam Fractionation:** This project will consist of developing a methodology and performing a series of experiments to validate a mathematical system to model the remediation of PFAS from water. There is significant potential for future work, provided this project shows promise.

		If you would like more detailed information or have any questions, please send me an email.

SCHOOL OF COMPUTER & MATHEMATICAL SCIENCES:

Researcher:	Research Area:	Available Project(s):
Professor Finnur Larusson	Pure mathematics	Please contact researcher for discussion.
Dr Feras Dayoub	Computer vision and machine learning for robotics	**A robot dog Companion - Autonomous Navigation and Interaction Using Computer Vision:** Spend your summer programming our quadruped robot dog to navigate autonomously and interact with its environment using computer vision. Leverage machine learning algorithms to recognize objects, track motion, and enhance robot responsiveness in real-world scenarios. Perfect for students passionate about robotics and AI! Contact researcher for discussion or any questions.
A/Prof. Hung Nguyen	Cybersecurity; Artificial Intelligence	**Adversary Simulation via Large Language Models such as (chat)GPT:** Defending enterprise networks against attackers continues to present a difficult challenge for blue teams. Prevention has fallen short; improving detection & response capabilities has proven to be a step in the right direction. However, without the telemetry produced by adversary behaviour, building new and testing existing detection capabilities will be constrained. In this project, we will develop adversary simulation plans for industry tools such as purplesharp - that executes adversary techniques within Windows Active Directory environments. The plans are obtained from open-source incident reports of real-world attacks. The resulting telemetry can be leveraged to measure and improve the efficacy of a detection engineering program. The plans leverage the MITRE ATT&CK Framework and include different techniques across the attack life cycle: execution, persistence, privilege escalation, credential access, lateral movement, etc. **Automobile Security - Hacking the CAN bus:** As automobiles have become increasingly sophisticated, the opportunities to hack them has increased commensurately. Electronic starting systems, remotes, Wi-Fi, GPS, alarms and lots of software each provide vectors to hack automobiles. Automobile electronics use several different protocols to communicate between the multiple micro-controllers, sensors, gauges, actuators, etc. The most widely used of these protocols is the Controller Area Network or CAN. We will investigate the weaknesses in the current CAN protocol using tools such as https://github.com/schutzwerk/CANalyzat0r or Metasploit for cars. We will then develop fixes for these security issues. The project will involve using CISCO equipment provided by our industry partner.

Dr Rahil Valani	Dynamical systems; Fluid dynamics; Chaos	**1. Walking droplets, quantum mechanics and the Lorenz system** **2. Dynamics of particles suspended in fluid flow through curved microchannels** Please contact researcher for discussion.
Dr. Mingyu Guo	Algorithmic Game Theory	**Multiagent reinforcement learning on graph with application to community battery:** The project aims to build a MARL environment for simulating decision-making (i.e., pricing, revenue vs carbon) behind community battery (community shared battery that stores excess solar energy during the day and then re-sell back to the community during the night).
Dr Cruz Izu	Computer Education Research	**Evaluation of code quality, code refactoring and using AI LLM for education purposes:** Please contact researcher for discussion.
Dr. Yongliang Qiao	Computer Science	**AI-based Object Detection and Tracking:** We will also explore techniques for improving the performance of object detection and tracking under complex environments. By improving the performance of object detection and understanding, we hope to contribute to the development of more reliable and efficient computer vision systems with a wide range of applications.
Dr Feras Dayoub	Machine Learning for Robotics	**Implementation of an Interactive Fetch-playing Quadruped Robot Using ROS, OpenCV, and PyTorch:** In this team-based summer project, participants will focus on introducing an autonomous fetch-play feature to Unitree's Go1 quadruped robot. Leveraging the Robot Operating System (ROS), a flexible platform for writing robot software, students will establish a system architecture to integrate machine learning and vision modules. The project will make use of OpenCV, a prominent library for computer vision tasks, to empower the robot to identify and track objects for fetch-play via its onboard cameras. Coding tasks for this component will primarily use Python and/or C++. The machine learning aspect of the project will utilize PyTorch, a widely used open-source machine learning framework. The primary focus will be on training the robot for object detection tasks, thereby improving the robot's efficiency and success rate over time in fetch-play. This project presents a unique opportunity to apply theoretical knowledge in computer vision, machine learning, and robotics in a practical context. It aims to emphasize the potential of these combined fields in the advancement of autonomous robotic applications.
Dr. Vince Wang	Operations Research	**Improve the decision-making in the meat supply chain:** In this project, we will apply operations research to support decision-making in the meat processing industry, and build the optimization model to develop operation plans in the meat supply chain.

Lewis Mitchell	Data Science	**Data Journalism:** This project is offered through the Adelaide Data Science Centre, and will explore the use of data science techniques in the emerging field of 'data journalism'. We will analyse a variety of collected datasets such as weather forecasts, fuel prices, and crime statistics, to extract trends that may support journalistic reporting on these topics. This will be in collaboration with journalists from the ABC News, and involve development of Python or R code for wrangling and analysing real datasets.
Dr Luke Bennetts	Applied Mathematics; Climate Science	Please contact researcher for discussion.
Dr Siu Wai Ho	Machine learning; Information theory; Telecommunications	**Latent Structure Discovery by an Information Theoretic Inequality Prover:** The project aims to develop new methods and algorithms for inferring latent structures in complex causal models. These models are important in areas such as healthcare, industry, and network security. The new methods use information theory to automate reasoning and generate human-verifiable proofs that are too large for humans to analyse. **Intelligent Algorithms for Communications and Positioning through Machine Learning:** Machine learning is revolutionising wireless networks by enabling intelligent, data-driven solutions for improved performance, reliability and connectivity. This project aims to develop advanced algorithms for wireless communication and positioning systems. Students will be guided to apply machine learning techniques to empirical measurement data.
Prof Mark Jenkinson	Machine Learning for Medical Data	**Deep learning segmentation of the substantia nigra in neuromelanin-sensitive, brain MRI:** This summer project aims to develop a deep learning method to segment an important anatomical structure, the substantia nigra, from MRI brain scans that highlight neuromelanin concentration. It forms a part of a larger research project that is investigating the links between traumatic brain injury and Parkinson's disease.

SCHOOL OF ELECTRICAL AND MECHANICAL ENGINEERING:

Researcher:	Research Area:	Available Project(s):
Prof. Withawat Withayachumnanul	Terahertz technology	**Terahertz Technology:** Terahertz waves are within the electromagnetic spectrum between the microwave and optics. This unique frequency range underpins promising applications in sensing, imaging, and communications. Specially, our group is working on 6G and beyond communications and non-destructive evaluation (imaging) of materials. We have a range of research activities that might match your interest. Find out more here: https://www.thz-el.org/ Our team comprises one

		postdoctoral researcher and around 10 HDR students. Please contact researcher for further discussion on a suitable topic.
Dr Ali Pourmousavi Kani	Power System, Electrification	**Battery Degradation Modelling for Heavy-Duty Electric Vehicles in Mining Environments:** For a student interested in green energy, battery electric vehicles, sustainable mining or similar, we are seeking a highly motivated intern to join our research team to develop battery degradation models suitable for modelling battery capacity deterioration in harsh environmental and operational settings for heavy-duty electric vehicles in open-pit and underground mines. Please contact researcher for discussion. **A Comparative Analysis of Electric vs Diesel Haul Trucks for Underground Mining:** Description: For a student interested in green energy, battery electric vehicles (BEVs), sustainable mining or similar, we are seeking a highly motivated intern to join our research team to conduct a comprehensive comparison between BEVs and diesel haul trucks in an underground mine setting. **Predicting Future Electricity Prices in Australia Using Open-Source Models and Public Data:** Forecasting future prices in the National Electricity Market (NEM) - Australia's wholesale electricity market - is crucial for predicting future costs of electricity for consumers. This research aims to develop a predictive model for future electricity prices in the NEM using open-source models and publicly available data. **Assessing the Cost of Consistent and Reliable Renewable Power Generation from Solar, Wind, and Battery Storage:** Renewable energy, despite its numerous benefits, is inherently variable and intermittent. To overcome this challenge and provide consistent and reliable power, comprehensive planning, technology utilisation, and cost analysis are required. This research project is designed to assess the cost-effectiveness of achieving a steady renewable power output from a specific set of solar and wind energy sources, which are complemented by battery storage.
Dr Andy Boes	Photonics, nonlinear optics, photonic integrated circuits	**Advanced Characterisation of Photonic Integrated Circuits:** This summer research project aims to semi-automise the characterisation of photonic integrated circuits by using state-of-the-art equipment in the photonic laser lab. As part of this project you will get hands on experience with lasers, optical fibres and photonic circuit chips. Please feel free to reach out (Andy.boes@adelaide.edu.au) for further information.
Dr Nghia Nguyen-Trong	Electromagnetics, Antennas and Propagation	Please contact researcher for further discussion.

Dr Wen Soong	Electrical and Electronic Engineering	**Robust Design of Electrical Machines:** There is increasing interest in the electrification of transportation. The performance of electric machines is sensitive to manufacturing variations. This project uses a case study of the effect of manufacturing variations on the cogging torque of electric machines to investigate the selection of designs which both perform well and are also less sensitive to tolerances.
Dr Zhao Tian	Renewable Energy, Thermal dynamics, fluid dynamics	**Solar car design, simulations, optimizations:** In this project, students will conduct numerical/experimental research on our new solar car, LUMEN III. The possible research areas include suspension systems, occupancy cell, aerodynamics, out fairing materials, etc.
Nataliia Sergiienko	Offshore renewable energy	Please contact researcher for discussion.
Dr Jiawen Li, Dr Alok Kushwaha, and Prof Robert McLaughlin	Biomedical Engineering	**Project 1: Minimising rotation distortion in ultrathin imaging devices** **Project 2: 3D-printed imaging catheter for more accurate cardiovascular disease detection** Please contact researcher for further discussion.
Dr. Zhiwei Sun	Thermo-fluid, Laser and optics, Fluid mechanics, Advanced imaging, Energy and Decarbonisation	**Generating supersonic micro-particles:** Please contact researcher for further discussion.
A/Prof Mathias Baumert	Biomedical Engineering	**Using AI to understand sleep better:** This research uses signal processing and machine learning to process large volumes of sleep data. The aim is to extract biomarkers that can predict long-term health outcomes.
Wen Soong	Electrical Engineering; Electric Power Engineering	**Sizing and Controlling Shallow, Medium and Deep Energy Storage in Power Systems:** There is substantial growth in the amount of energy storage in the Australian power system. Energy storage can be classified as shallow (e.g batteries), medium (e.g. solar thermal) and deep (e.g. large hydro) depending on the storage time. This research work examines how to size the amount of each type of storage and how to control it in real-time.
John Codrington	Aircraft Structural Integrity	**Multiple Defence and industry relevant projects are available relating to aircraft structural integrity:** Fatigue life testing and prediction, structural digital twin modelling, damage diagnosis and prognosis, and other topics. Projects may cover experimental testing as well as theoretical modelling. Engagement with industry SMEs and stakeholders will be provided.
Dr Hong Gunn Chew	Machine learning network characterisation	**Characterisation of devices within private and encrypted networks:**

		Characterisation of internet devices is essential for monitoring and management of networks and their infrastructure, for both Cyber and network security requirements. Users and organizations are increasingly employing VPNs, TORs, or other proxy based anonymisation schemes for security or other reasons. The goal of this research is to devise and develop techniques and tools for device characterisation in spite of the above network device and traffic anonymisation challenges. ****Australia citizenship is required.**
Dr Ley Chen	Robotics	**1. Shear magic by robotic biodefleecing** **2. In-situ soil sampling for farmers** **3. Vibrational monitoring for online machine health check** **4. Real-time accidental falls monitoring system in aged care** Please contact researcher for discussion.
Dr Kim Harvey	Systems Engineering and Maritime Engineering	**Developing Capabilities of Small Underwater Vehicles:** Research using an existing small underwater vehicle and digital twin prototype. Capabilities to explore include autonomy, undetected operation, data communication, and remote recharging. Projects vary based on skills and interests, allowing for tailored experiences. Please contact researcher for discussion.
Rey Chin	Fluid mechanics; CFD	**Designing a hypersonic plane:** You will be co-designing a hypersonic plane that we will evaluate using CFD. **Designing the next generation of medical stents:** The project will include conducting further research on the mechanical designs of stents, building upon the research conducted during the master's research course where a number of stents were analysed computationally in terms of wall shear stresses, pressure drops, and to then conduct validation experiments including particle image velocimetry and any other relevant experiments to validate research findings. Ultimately, the student aims to create a publication of the research findings that will be suitable for scientific or engineering journals. I have a list of projects. Please contact me for discussion.
Dr Zhiwei Sun	School of Electrical and Mechanical Engineering	**Natural gas pyrolysis on molten salt surface for H2 production:** The project is to design a small-scale high-temperature rig to experimentally study the fundamental chemical process related to natural gas pyrolysis for grey/blue hydrogen production, being suitable for students from mechanical and chemical engineering schools.

SCHOOL OF PHYSICS, CHEMISTRY & EARTH SCIENCES:

Researcher:	Research Area:	Available Project(s):
Dr Stefan Loehr	Earth Science	**Multiple projects:** Spanning fundamental research (Earth System evolution) to applied (formation and characterisation of clay-hosted REE deposits). Contact researcher for discussion.
Dr Sarah Scholten	Physics; Optical Clocks; Molecular Spectroscopy	**Research projects available on both the Portable Optical Atomic Clocks and Molecular spectroscopy for Medical Breath Analysis research areas.** Please contact researcher for discussion.
A/Prof. James Zanotti	Physics	**Topics include lattice QCD studies of: proton structure, weak matrix elements, QED effects.** Projects generally involve writing your own code to analyse existing lattice QCD data. If you have no programming experience, we will teach you how to do this using Python. Please contact researcher for discussion.
Prof Gregory F. Metha	Chemistry	**Advancement of photocatalytic water-splitting for hydrogen production** Please contact researcher for discussion.
Prof. David Ottaway and Dr. Ori Henderson-Sapir	Physics; Lasers; Gravitational wave detection	**Glass 3D printing Design of for setup chassis for glass 3D printing using mid-infrared lasers:** We're developing a mid-IR fibre laser primarily for 3D glass printing. A summer project is now available for developing, constructing, and testing the laser's moving bed/galvo system. This project suits students with backgrounds in physics, mechanical, electronic, or mechatronic engineering.
Prof. David Ottaway and Dr. Ori Henderson-Sapir	Physics; Lasers; Gravitational wave detection	**Numerical code development for simulating a new type of fibre laser:** We're developing a novel mid-infrared fiber laser, requiring adaptation of an existing numerical code from an older model. The project involves a literature review, spectroscopy data analysis, and code adaptation. The code, initially in MATLAB, may be transitioned to JULIA.
Prof. David Ottaway and Dr. Ori Henderson-Sapir	Physics; Lasers; Gravitational wave detection	**Developing a new approach for numerical modelling of rate equations in fiber lasers for faster simulation:** The mid-IR fiber laser team has created a numerical simulation code using differential rate equations. A recent advancement in the field suggests a potentially more efficient computational approach. This project aims to enhance our existing work by improving the current model to accelerate simulations.
Dr. Ori Henderson-Sapir and Prof. David Ottaway	Physics; Lasers; Gravitational wave detection	**Splicing of fluoride based optical fibers and dissimilar fibers:** Monolithic mid-infrared fiber lasers are crucial for efficient field deployments. Our project focuses on developing splicing techniques between fluoride-based optical fibers and other fiber types. These new recipes will be implemented in the design of fiber lasers intended

		to be used at OzGrav for the improvement of gravitational wave detection.
Prof Heike Ebendorff-Heidepriem	Chemistry and physics of optical glasses and fibres including design, fabrication and characterization	**Multiple projects are available:** 3D printing of glass; development of diamond particles doped glass/fibre - fabrication and characterization; new etching recipe for fluoride glass; fabrication of polymer micro-structured fibres for Terahertz guidance; decreasing detection limit for chemical analysis of glass. Please contact researcher for discussion.
Prof. Kishan Dholakia	School of Biological Sciences	**Schlieren imaging of acoustic traps:** Schlieren imaging uses spatial filtering to allow us to observe liquid or gas fluid flow to identify regions of high and low density. You'll use this technique to image our acoustic trap that uses sound waves to trap macroscopic particles. You will build a setup and analyse the images obtained. **Raman spectroscopy for whisky identification and contamination detection:** Raman spectroscopy measures molecular vibrational bands by inelastic light scattering. You'll use this to identify brands and the molecular constituents of whisky and/or presences of contaminants. We use this to identify if the whisky has been tampered with. Help us refine this system and develop techniques for this application. **Laser beam shaping: exploring vortex beams and wavefront detection:** Shaping light can lead to laser fields that overcome diffraction and can create phase singularities (vortices). You'll explore these unusual transverse spatial mode profiles and measure the optical phase, amplitude and propagation properties. Such vortex beams/twisted beams will be used to test new ways of manipulating and imaging biological samples.
Thomas de Prinse and Dr Jillian Moffatt	Physics	**Novel Fluorescence for Spoilage Detection and Growth Indicators** The fluorescence of organic matter changes with changing metabolic and organic processes. In this project you will use laboratory and in-field imaging systems to map changes in fluorescence of various organic matter (foodstuffs, etc.) over time. The aim of the project is to indicate whether fluorescence can be used to indicate spoilage, growth, and ageing of organic products before more obvious indicators are present.
Thomas de Prinse	Lasers and Environmental Sensing	**Our optical sensing technology is being developed in our lab looking at the natural emission signatures of materials such as fuels, plastics and minerals.** The technology aims to optimise processes to allow for less energy to be used and less waste to produced. Contact researcher for discussion on specific projects.